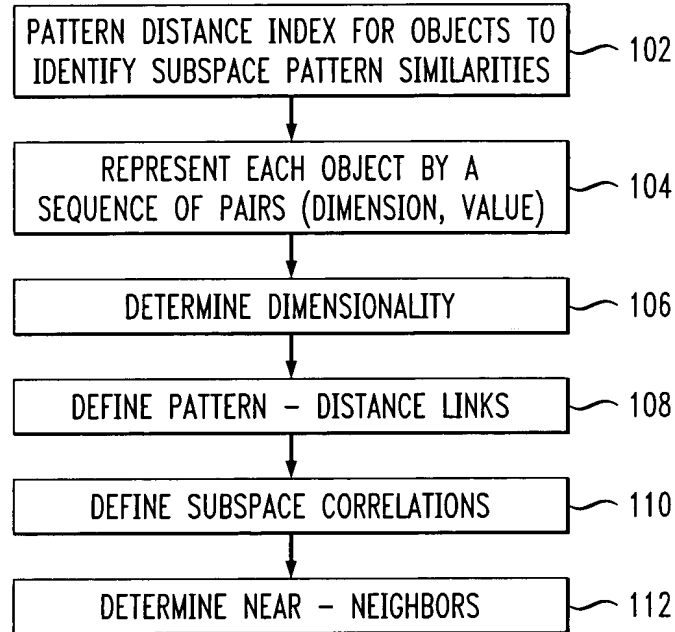


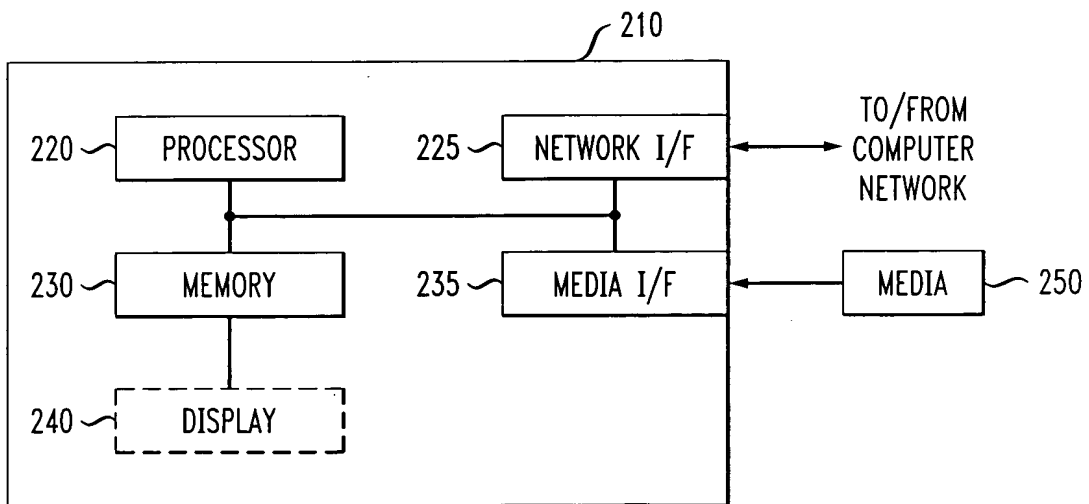


*FIG. 1*

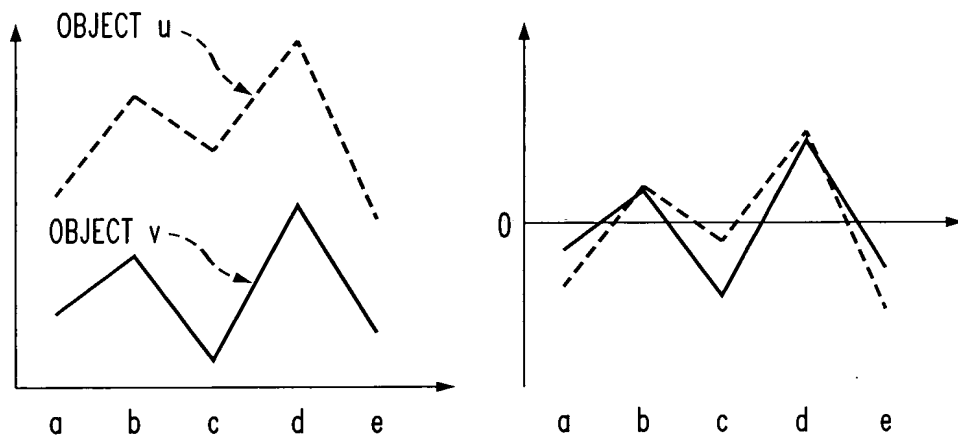


*FIG. 2*

200



*FIG. 3*



*FIG. 4*

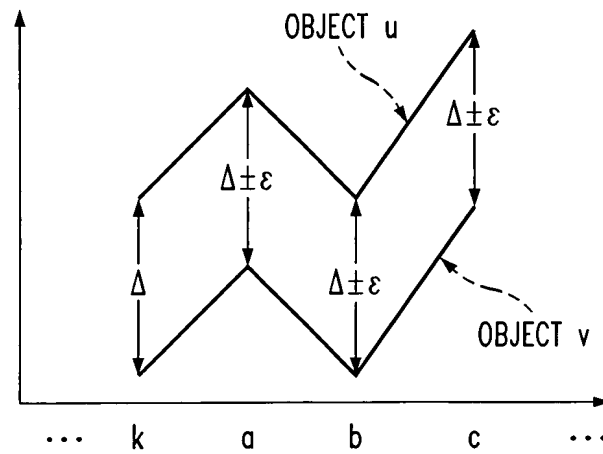
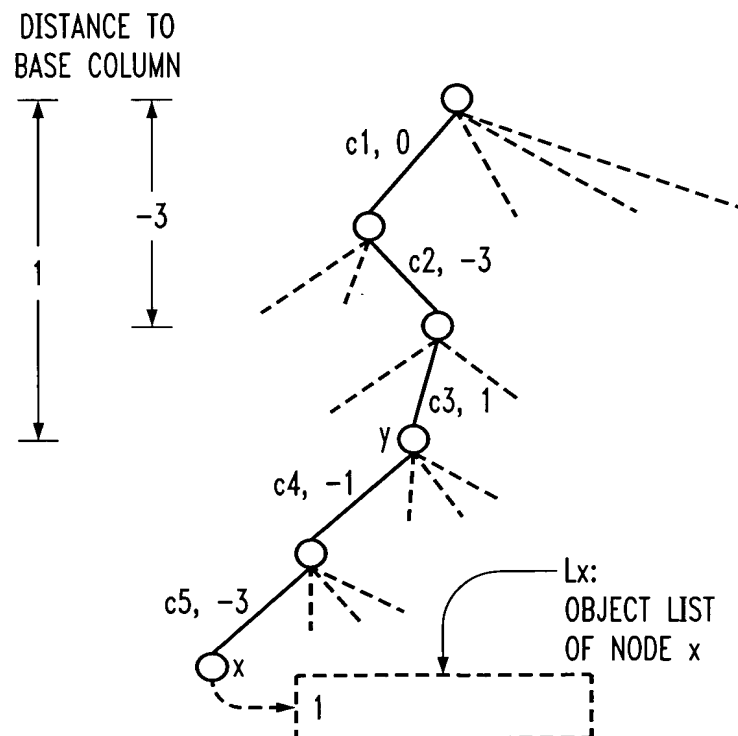


FIG. 5

$f(u,i)$ , where $u \in \{\#1, \#2\}$ and $i = 1, \dots, 4$				
$(c_1, 0)$ ,	$(c_2, -3)$ ,	$(c_3, 1)$ ,	$(c_4, -1)$ ,	$(c_5, -3)$
	$(c_2, 0)$ ,	$(c_3, 4)$ ,	$(c_4, 2)$ ,	$(c_5, 0)$
		$(c_3, 0)$ ,	$(c_4, -2)$ ,	$(c_5, -4)$
			$(c_4, 0)$ ,	$(c_5, -2)$
$(c_1, 0)$ ,	$(c_2, -3)$ ,	$(c_3, 1)$ ,	$(c_4, -1)$ ,	$(c_5, 2)$
	$(c_2, 0)$ ,	$(c_3, 4)$ ,	$(c_4, 2)$ ,	$(c_5, 5)$
		$(c_3, 0)$ ,	$(c_4, -2)$ ,	$(c_5, 1)$
			$(c_4, 0)$ ,	$(c_5, 3)$

FIG. 6



*FIG. 7*

**Input:**  $T$ : a trie built on  $D$   
 $S$ : a subspace defined by a continuous column  
 set  $\{c_i, c_{i+1}, \dots, c_k\}$   
 $q = (c_1, v_1), \dots, (c_n, v_n)$ : a query object  
 $\epsilon$ : pattern threshold

**Output:** near-neighbors of  $q$  in subspace  $S$

$n \leftarrow \text{root of } T$ ;  
 $\text{search}(n, S)$ ;

**Function**  $\text{search}(x, S)$

**if**  $S = \emptyset$  **then**

    output the descendents of  $x$ ;

**else**

    assume  $S = \{c_j, c_{j+1}, \dots, c_k\}$ ;

**for**  $x$ 's child node  $y$  under edge labeled  $(c_j, v)$   
     where  $v \in [(v_j - v_i) - \epsilon, (v_j - v_i) + \epsilon]$  **do**  
          $\text{search}(y, \{c_{j+1}, \dots, c_k\})$ ;

*FIG. 8*

**Input:**  $D$ : objects in multi-dimensional space  $A$

**Output:** PD-Index of  $D$

**for each**  $u \in D$  **do**

    insert  $f(u, i)$ ,  $1 \leq i < |A|$  into a trie; (Eq 5)

**for each node**  $x$  encountered in a depth-first traversal of the trie **do**

    label node  $x$  by  $\langle n_x, s_x \rangle$ ;

    let  $(c, d)$  be the arc that points to  $x$ ;

    append  $\langle n_x, s_x \rangle$  to pattern-distance link  $(c, d)$ ;

FIG. 9A

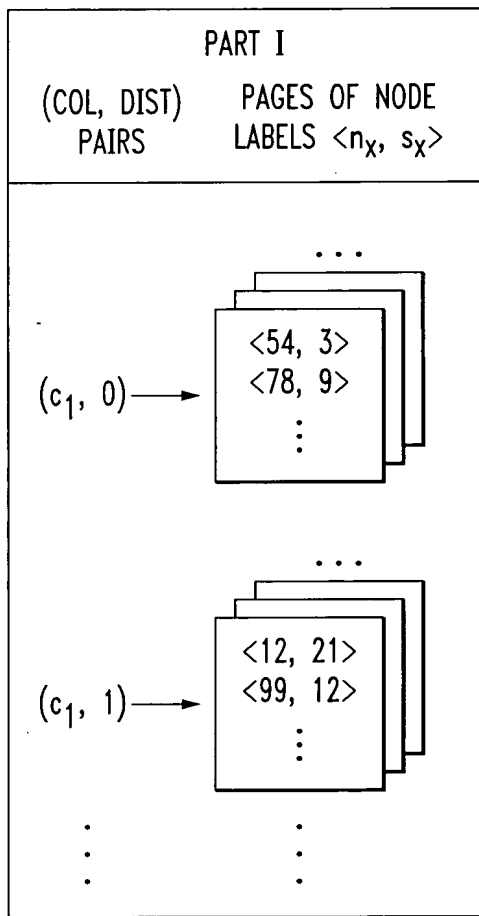
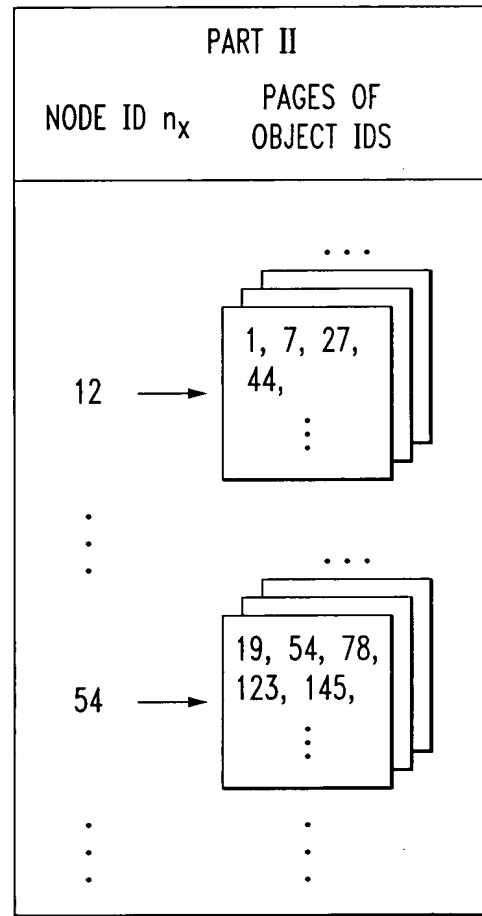


FIG. 9B



*FIG. 10*

**Input:**  $q$ : a query object,  $S$ : a given subspace

$\epsilon$ : pattern threshold

**Output:**  $q$ 's near-neighbors in subspace  $S$

let  $(c_1, v_1), \dots, (c_{|S|}, v_{|S|})$  be  $q$ 's projection on  $S$ ;

$x \leftarrow$  the node under arc  $(c_1, 0)$ ;

$search(x, 2)$ ;

**Function**  $search(x, i)$

**if**  $i \leq |S|$  **then**

**for** pattern distance link  $I$  of  $(c_i, v)$ , where  $v \in [v_i - \epsilon, v_i - v_1 + \epsilon]$  **do**

        /\* perform a binary search on  $I$  \*/

**for** all node  $r \in I$  and  $n_r \in [n_x, n_x + s_x]$  **do**

$search(r, i + 1)$ ;

**end**

**end**

**else**

    output objects in  $L_x$ ,  $x = v_s, \dots, v_m$

**end**

FIG. 11

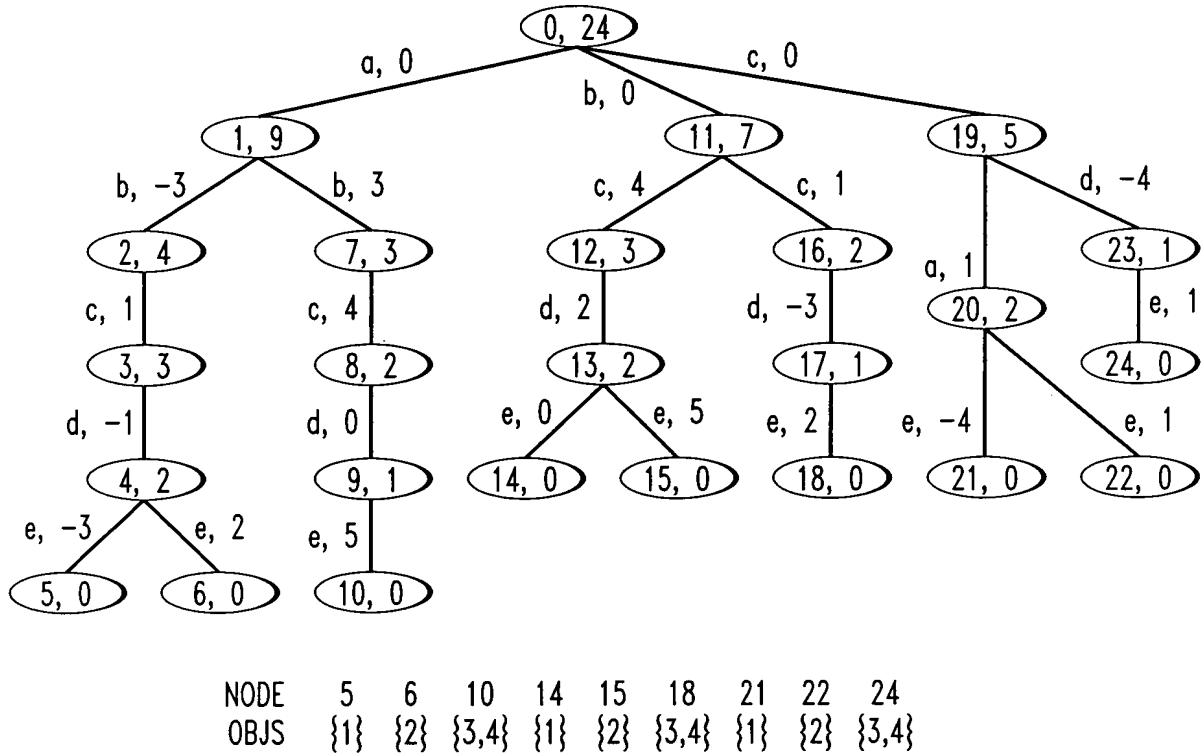
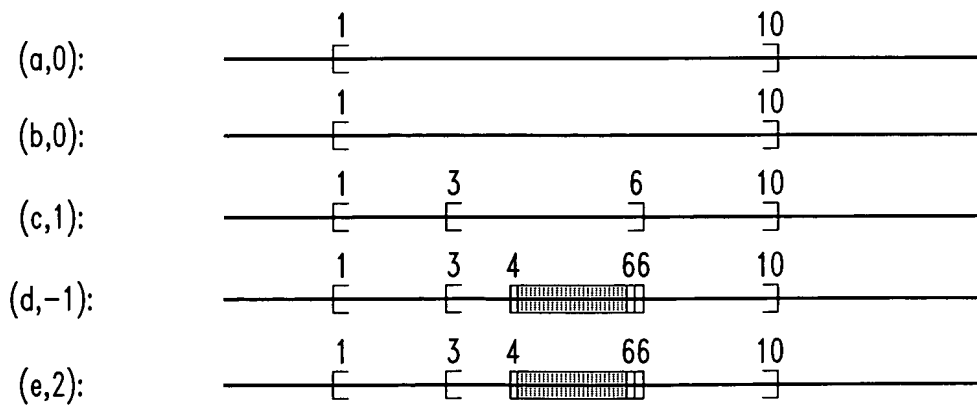


FIG. 12

AFTER CHECKING

RESULT



*FIG. 13*

```

Input:  $q = (c_1, v_1), \dots, (c_n, v_n)$ : a query object
          $r$ : distance threshold,  $\epsilon$ : pattern tolerance
          $F$ : index file for  $D$ 
Output:  $NN(q, r)$ 

for  $i = 1, \dots, r + 1$  do
     $R \leftarrow$  the range of the (only) node in link  $(c_i, 0)$ ;
     $j \leftarrow i + 1$ ;
    while  $R \neq \emptyset$  and  $j \leq |A|$  do
        search link  $(c_j, v)$  for nodes inside any range of
         $R$ , where  $v \in [v_j - v_i - \epsilon, v_j - v_i + \epsilon]$ ;
        update  $R$  by adding the ranges of those nodes;
        if a region  $s$  of  $R$  is inside  $|A| - r$  brackets then
            output objects in  $L_x$  where  $x \in s$ ;
            eliminate  $s$  from  $R$ ;
        end
        if a region  $s$  of  $R$  is inside less than  $r - j$  brackets
        then
            eliminate the region from  $s$ ;
        end
         $j \leftarrow j + 1$ ;
    end
end

```



FIG. 14A

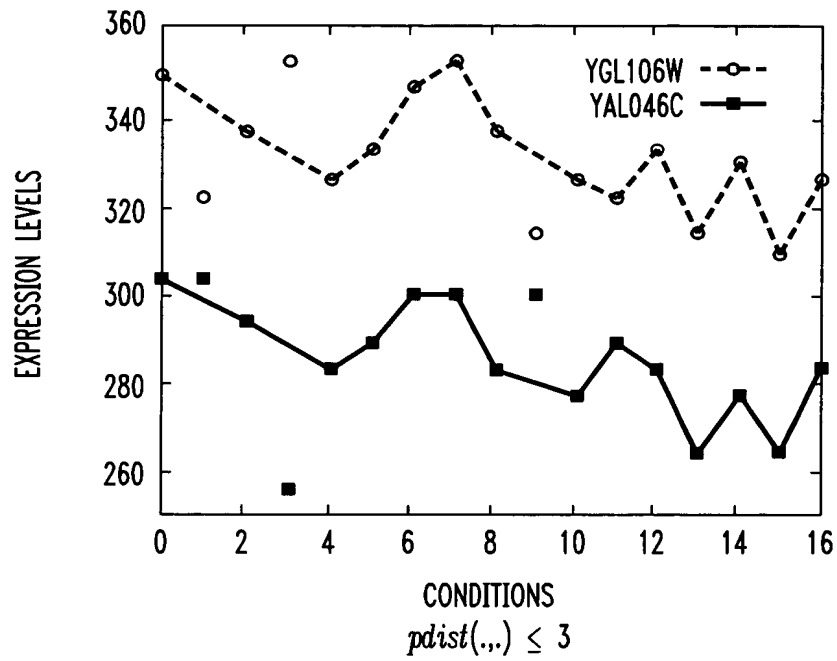
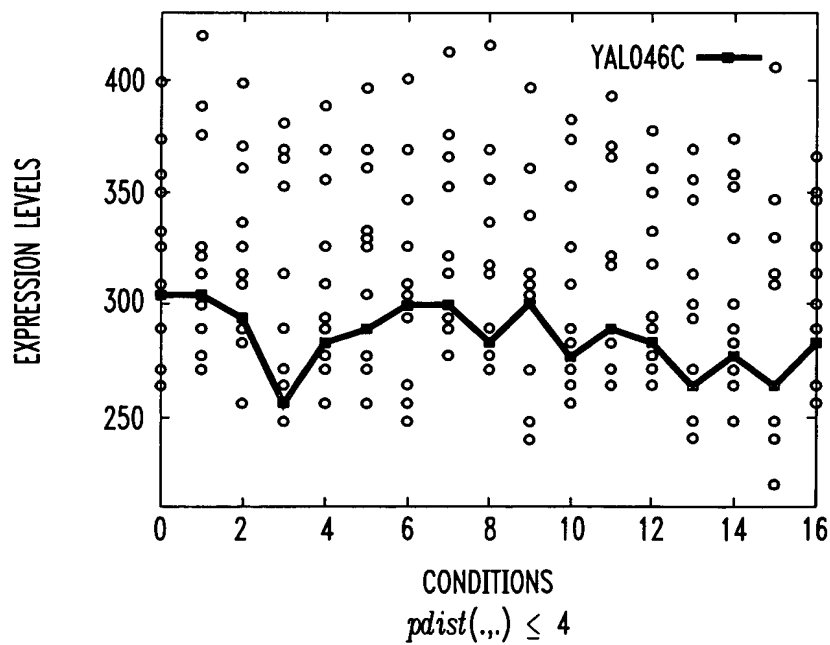
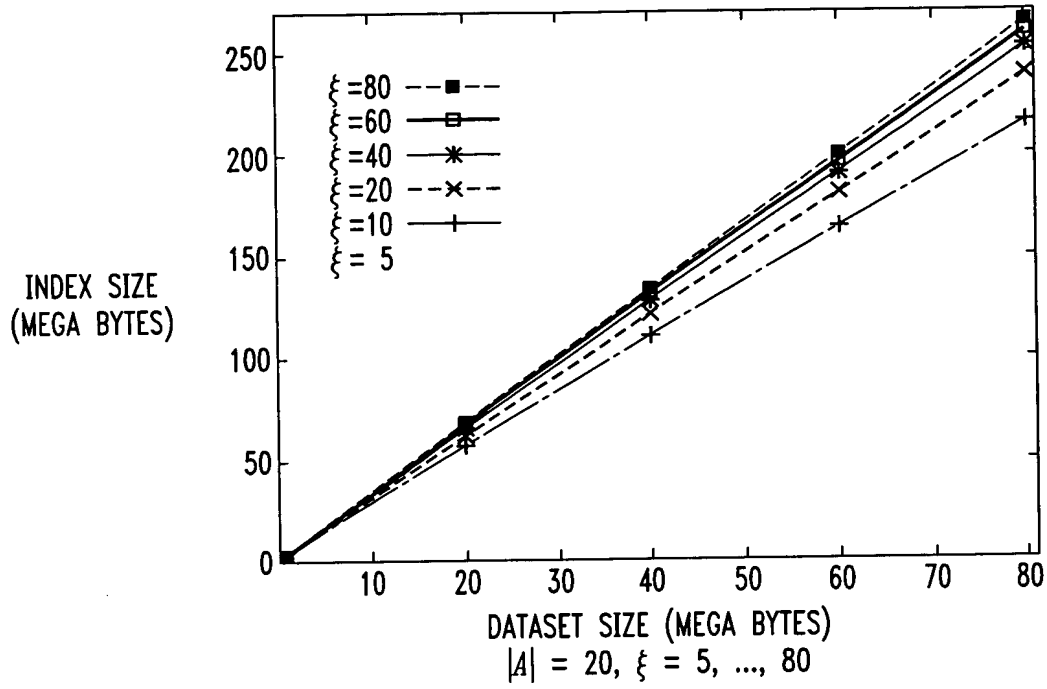


FIG. 14B



*FIG. 15A*



*FIG. 15B*

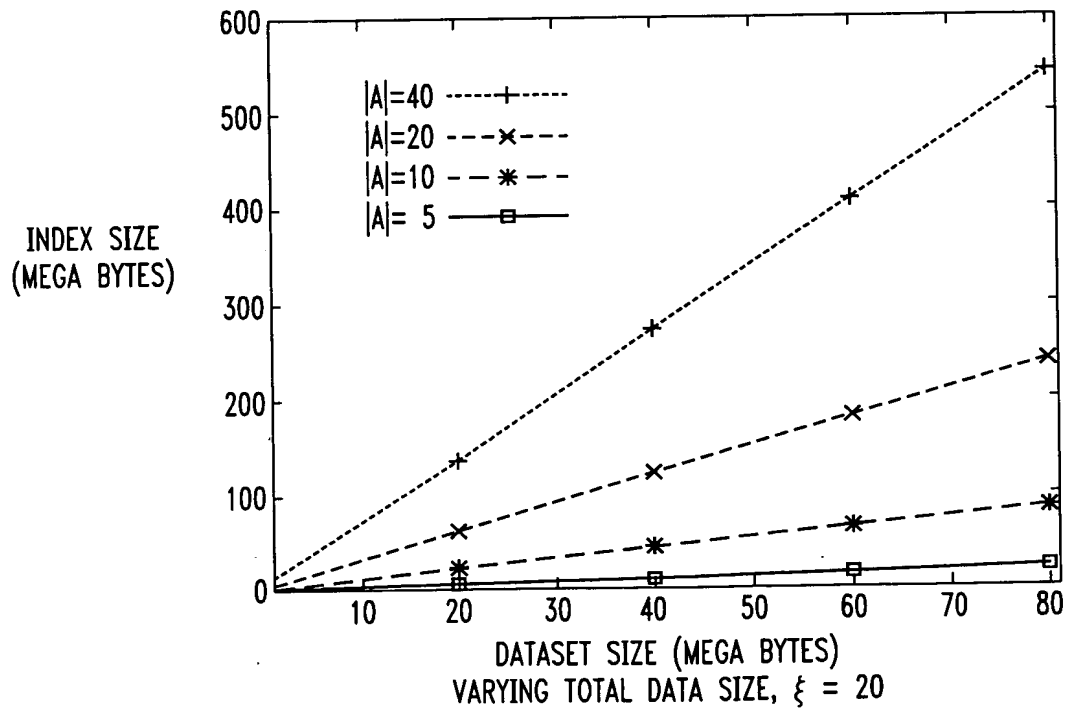


FIG. 15C

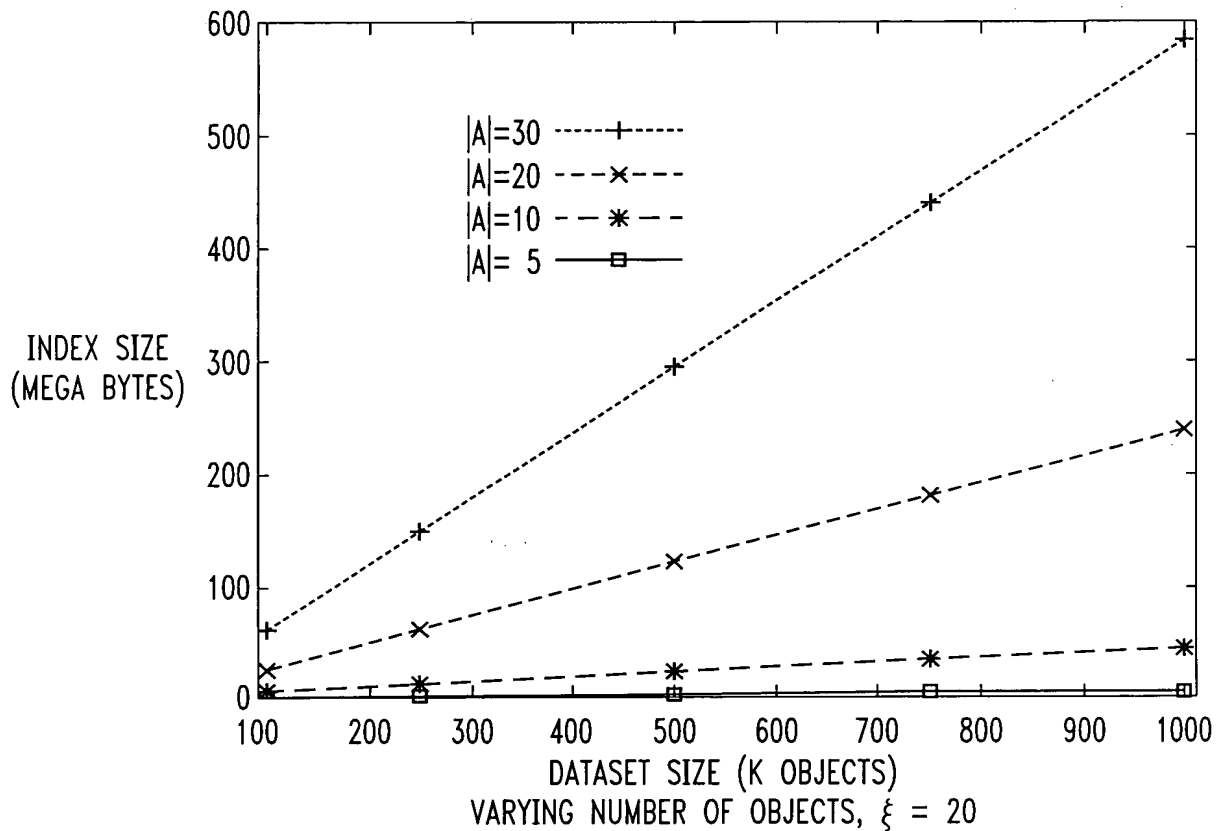


FIG. 16A

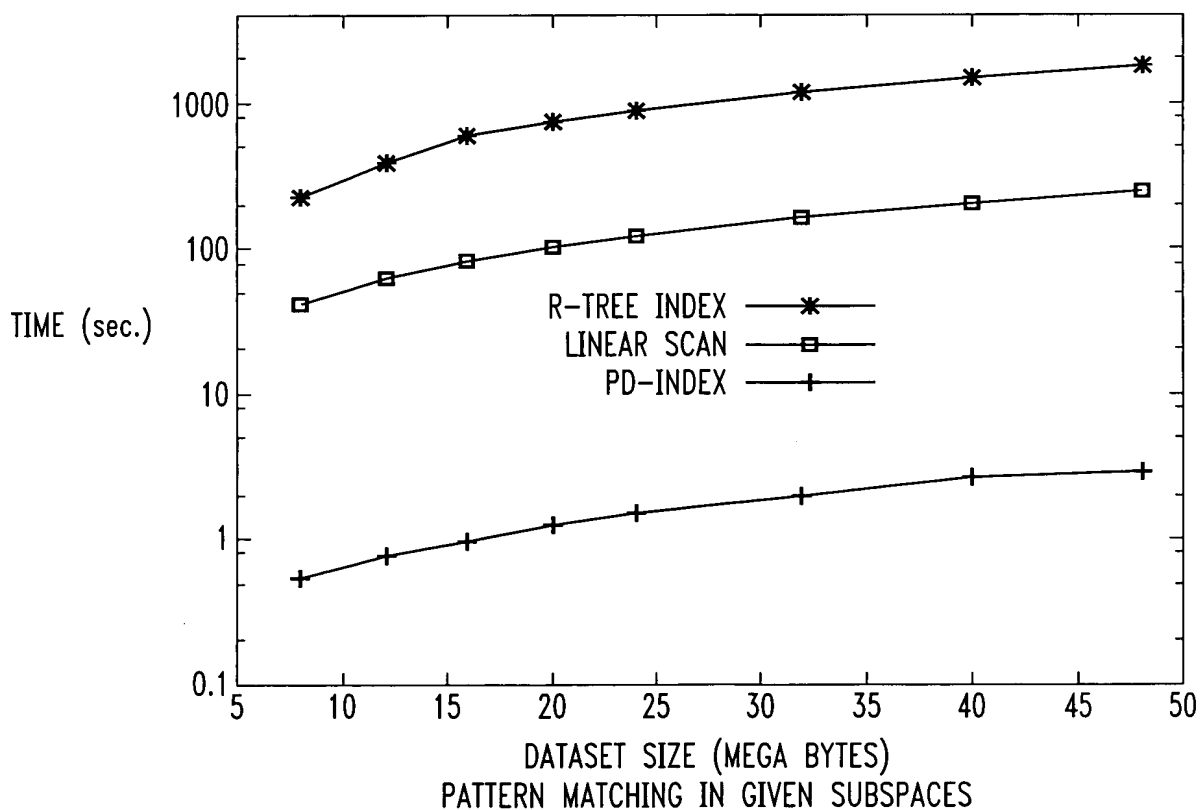


FIG. 16B

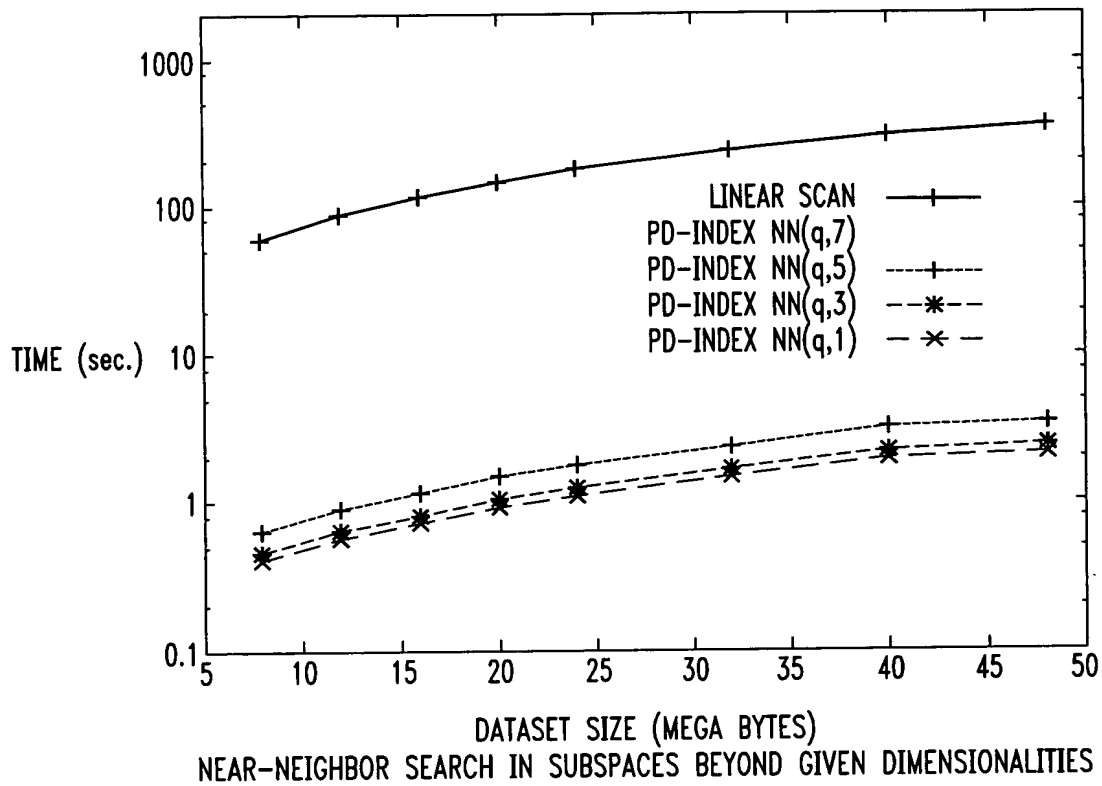
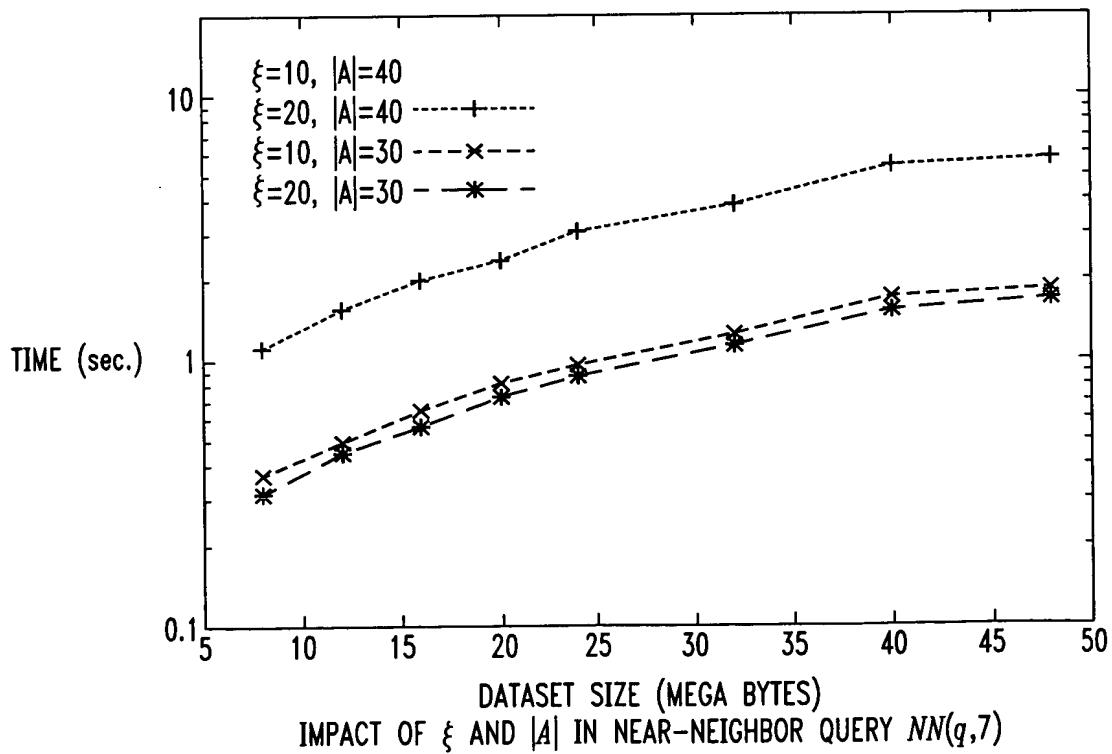
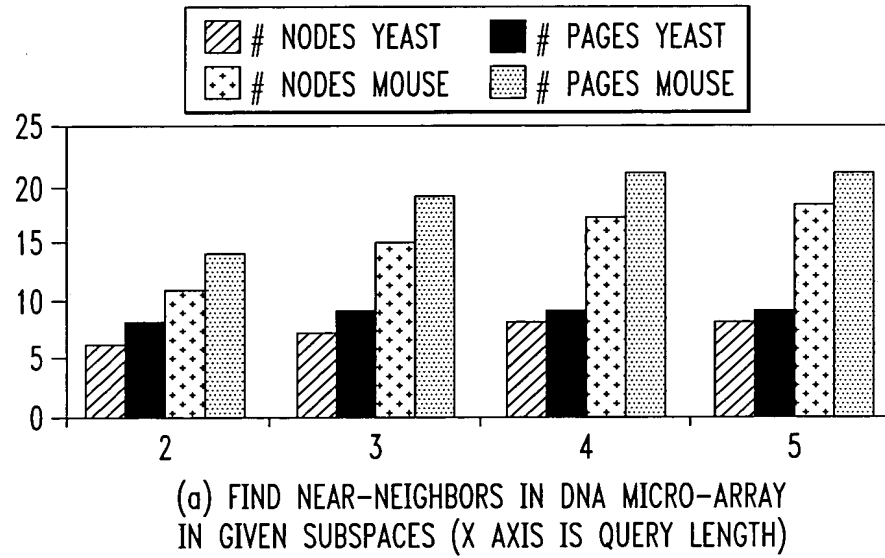


FIG. 16C



*FIG. 17A*



*FIG. 17B*

